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Teacher Readiness for Coding and Artificial Intelligence (CAI) Integration in Classroom Practice

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ABSTRACT

This study investigates teachers' readiness to integrate coding and artificial intelligence (AI) into school curricula and proposes strategic directions based on strengths, weaknesses, opportunities, and threats (SWOT) analytical framework. A quantitative descriptive approach was adopted involving 174 teachers from elementary, junior, and senior secondary schools across West Java, Indonesia. Data were collected through structured Likert-scale questionnaires and open-ended responses, then analyzed using the Internal and External Factor Analysis Summary (IFAS–EFAS) matrices to determine the strategic position. The results indicate that internal strengths, particularly teachers' motivation toward digital innovation and strong institutional support, play a more significant role than weaknesses such as limited technical skills and training opportunities. The overall SWOT scores show that strengths (4.85) and opportunities (5.00) exceed weaknesses (3.95) and threats (3.51), positioning teacher readiness in the Strength–Opportunity quadrant, with the S–O strategy obtaining the highest score (9.85). These findings suggest that teachers' internal capacities should be optimized to leverage external opportunities through continuous professional development, digital infrastructure enhancement, and cross-sector partnerships. Overall, the study concludes that teacher readiness for coding and AI integration is progressing positively, provided that sustained institutional commitment and consistent policy implementation continue to support digital transformation in education.

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Introduction

Digital transformation is a global phenomenon that has reshaped human life, including the field of education. This transformation requires not only mastery of basic literacy skills, such as reading, writing, and numeracy, but also digital literacy, which serves as a foundation for twenty-first-century skills [1]. One important aspect of digital literacy is computational thinking (CT), popularized by Wing [2] as a logical, systematic, and algorithmic way of thinking in solving problems. CT is closely related to coding, which is now regarded as a fundamental skill for navigating the era of the Fourth Industrial Revolution. Coding enables students to understand programming logic, which underlies various digital technologies, and is believed to improve computational thinking skills [3].

Indonesia has responded to this challenge through several policies in the education sector. One of these is the policy on coding and artificial intelligence (CAI) learning. This policy provides schools with opportunities to develop curricula according to local needs while responding to global developments. It has been emphasized that the direction of the CAI learning policy is designed to prepare students to face the challenges of the digital era [4].

The government has also launched various programs to improve digital literacy, including coding and AI training for teachers. Nevertheless, a gap remains between the direction of national policies and realities in the field. Some schools, particularly those in urban areas, have begun to adopt digital learning, whereas schools in other regions continue to face limitations in infrastructure and teacher competence. This indicates that macro-level policies alone are insufficient; micro-level readiness among schools and teachers is a determining factor in the success of digital transformation.

Teachers play a central role in the implementation of coding and artificial intelligence in schools. Teacher readiness is not limited to the availability of hardware or digital infrastructure but also encompasses competence, motivation, attitudes toward innovation, and institutional support. Teachers with strong technological literacy can more easily integrate coding and artificial intelligence into learning, whereas less-skilled teachers may encounter significant barriers. Empirical evidence confirms that teacher readiness is a critical factor in the successful adoption of educational technologies in schools, including coding and AI [5] [6] [7]. Therefore, building teacher capacity is as important as providing learning facilities.

The urgency of implementing coding and artificial intelligence in schools has been further reinforced by the issuance of recent regulations. The Ministry of Primary and Secondary Education [8] issued Regulation of the Minister of Primary and Secondary Education Number 13 of 2025, which stipulates that Coding and AI will be introduced as elective subjects at the elementary school level (Grades 5–6), junior secondary school level (Grades 7–9), and senior secondary and vocational school levels (Grades 10–12), beginning in the 2025/2026 academic year. This regulation signifies that coding and artificial intelligence are no longer merely supplementary programs but have been institutionalized as part of the national education curriculum.

As a follow-up measure, the government has also prepared an academic paper that serves as the conceptual foundation for implementing coding and artificial intelligence in primary and secondary schools [4]. The document outlines the core competencies students are expected to achieve, strategies for teachers' professional development, and technical support in the form of instructional materials. Furthermore, Decree of the Minister of Primary and Secondary Education Number 005/H/P/2025 was issued to designate supplementary textbooks used as references for coding and artificial intelligence learning in schools [9]. Thus, government policies have established a clear regulatory framework for the implementation of coding and artificial intelligence, making school and teacher readiness an urgent issue for investigation.

Based on the foregoing discussion, the main issue concerns the readiness of teachers and schools to implement coding and artificial intelligence in accordance with the national policy framework. This readiness encompasses internal factors, such as teacher competence, school management support, and infrastructure availability, as well as external factors, such as government policies, technological trends, and barriers arising from social and economic conditions. The issue becomes increasingly complex because schools differ in terms of geographical location, managerial capacity, teacher backgrounds, and levels of digital development across regions. This issue is consistent with UNESCO's report on the digital divide [10] which emphasizes that disparities in access to technology may hinder educational transformation. In the Indonesian context, this gap presents a substantial challenge because the quality of educational infrastructure remains uneven. Therefore, implementation strategies should emphasize not only teacher training but also equitable access to digital devices.

In general, this study seeks to answer the question of how prepared teachers and schools in West Java are to implement coding and artificial intelligence learning from a SWOT analysis perspective. The main research questions are as follows: (1) What internal factors constitute the strengths and weaknesses of teachers and schools in the CAI implementation process?

(2) What external factors constitute opportunities and threats in the implementation of CAI? (3) What strategies are appropriate, based on the results of the SWOT analysis, to ensure the effective implementation of CAI? These questions provide a fundamental framework for identifying the strategic position of schools and teachers in responding to the digital transformation of education through coding and artificial intelligence learning.

In line with the research questions above, this study aims to describe and analyze the readiness of teachers and schools in West Java to implement coding and AI using a SWOT approach. More specifically, this study aims to: (1) identify internal factors in the form of strengths and weaknesses in the implementation of CAI; (2) identify external factors in the form of opportunities and threats in the implementation of CAI; and (3) determine implementation strategies that are consistent with the results of the SWOT analysis. Through these objectives, this study is expected to make a practical contribution to the development of school policies while also providing an academic contribution to the literature on digital readiness.

The literature further reinforces the urgency of this study. Several recent studies have confirmed that coding and artificial intelligence skills have become fundamental components of twenty-first-century digital education. Guan et al. [11] demonstrated that AI literacy is positively correlated with students' computational thinking and problem-solving abilities, indicating that coding and AI education is no longer an optional supplement but a fundamental requirement in the school curriculum. Through a systematic review of AI education in K–12 settings, Lee and Kwon [12] emphasized that the integration of AI into classrooms promotes more personalized, interactive, and contextual learning, particularly when supported by programming-based activities. Meanwhile, Walter [13] highlighted the role of coding as a bridge between technology education and the development of critical, ethical, and creative thinking.

In the context of teacher readiness, various studies have underscored the importance of pedagogical aspects and attitudes toward innovation in addition to technical competence. Aljemely [14] found that most teacher training programs still focus on the use of digital tools without developing a conceptual understanding of how AI can be meaningfully integrated into teaching practices. These findings are consistent with Wang et al. [15] who demonstrated that teachers' intentions to use AI-based technologies are strongly influenced by their perceptions of educational benefits, digital self-confidence, and institutional support.

SWOT analysis is a relevant approach for examining the readiness of schools and teachers. IFAS (Internal Factor Analysis Summary) and EFAS (External Factor Analysis Summary) are used to assign weights to strengths, weaknesses, opportunities, and threats. This method has widely applied in various educational studies to map institutional strategies for responding to change, but it has rarely been applied specifically to readiness for implementing coding and artificial intelligence. This study seeks to address this gap by integrating SWOT analysis with teacher-readiness data to provide a comprehensive overview.

Thus, this study offers novelty by positioning teachers and schools as the primary focus within the context of implementing the latest policies on coding and AI. The established regulations provide a clear direction, but readiness at the implementation level remains a determining variable. This study is expected to provide relevant strategic recommendations for teachers, schools, and policymakers so that digital transformation in Indonesian education can be implemented more effectively. This chapter provides an important foundation that connects the global context, national policies, teacher readiness, and the conceptual framework to be further discussed in this study.

Methods

This study employed a quantitative approach using a descriptive method combined with SWOT analysis (Strengths, Weaknesses, Opportunities, and Threats). This approach was selected to measure teachers' readiness to integrate coding and artificial intelligence (AI), while simultaneously mapping the internal and external factors that influence such readiness. SWOT analysis was considered appropriate because it enables researchers to identify strengths, weaknesses, opportunities, and threats and subsequently formulate suitable implementation strategies. This analysis was also selected because it can be used for rapid decision-making while increasing decision-makers' confidence in the decisions they make [16]. In addition to its use in the business sector, strategies formulated based on an appropriate SWOT analysis can also contribute to improving the quality of education [17].

During the research process, data were collected using a questionnaire instrument developed based on the SWOT indicators presented in Table 1. The questionnaire consisted of several closed-ended statements measured using a Likert scale. The indicators were developed through an expert judgment process. The questionnaire also included several open-ended questions intended to explore teachers' perspectives and experiences regarding the opportunities and obstacles associated with the implementation of coding and AI in greater depth. Data from the closed-ended questions were analyzed quantitatively according to the SWOT indicators adopted from Rangkuti [18] to calculate the IFAS and EFAS scores. The scores were then plotted on a Cartesian diagram to determine the dominant strategy. Data obtained from the open-ended questions were analyzed thematically to complement the quantitative findings.

Table 1: SWOT Analysis Indicators of Readiness for the Implementation of Coding and Artificial Intelligence Learning

Indicator	Code
Strengths	
1. I have a strong personal interest in digital technology.	S1
2. I am accustomed to using technological devices in my daily teaching practices.	S2
3. My school supports the integration of technology into the learning process.	S3
4. I possess basic skills in understanding programming/coding logic.	S4
5. I feel confident in learning new concepts related to coding and artificial intelligence.	S5
Weaknesses	
1. I do not yet have experience teaching coding and artificial intelligence materials.	W1
2. I feel that I have an insufficient understanding of the basic concepts of computer programming.	W2
3. I have difficulty accessing coding and artificial intelligence materials or learning resources because of limited facilities.	W3
4. I have never participated in formal training on coding and artificial intelligence.	W4
5. A lack of time for independent learning is an obstacle to developing my digital competence.	W5
Opportunities	
1. The government or local education authority provides support for coding and artificial intelligence programs in schools.	O1
2. Many online training programs and free learning resources on coding and artificial intelligence are available.	O2
3. The Merdeka Curriculum, with its deep learning approach, provides opportunities to explore technology in learning.	O3
4. Students today tend to be enthusiastic about digital technology.	O4
5. I see opportunities for career development through mastery of coding and artificial intelligence.	O5
Threats	
1. Not all of my colleagues support coding and artificial intelligence learning.	T1
2. Limited technological infrastructure in schools is a major obstacle.	T2
3. The lack of clear technical guidelines from the relevant authorities results in suboptimal implementation.	T3
4. Differences in technological competence among teachers make teamwork difficult.	T4
5. Some parents or members of the community still question the importance of coding and artificial intelligence in the curriculum.	T5

The entire research process adhered to ethical principles, including obtaining respondents' consent, maintaining the confidentiality of their identities, and using the data exclusively for academic purposes. Respondents were given complete freedom to participate, and all collected data were treated anonymously. Through this simple yet systematic method, the study is expected to provide a clear overview of teacher readiness and establish a strategic.

Results and Discussion

This study involved 174 teachers from various levels of education in West Java, with respondents ranging in age from under 30 years to over 50 years. Their teaching experience also varied, ranging from less than five years to more than ten years, as presented in the graph in Figure 1. This composition demonstrates a relatively balanced diversity of experience between senior and younger teachers.

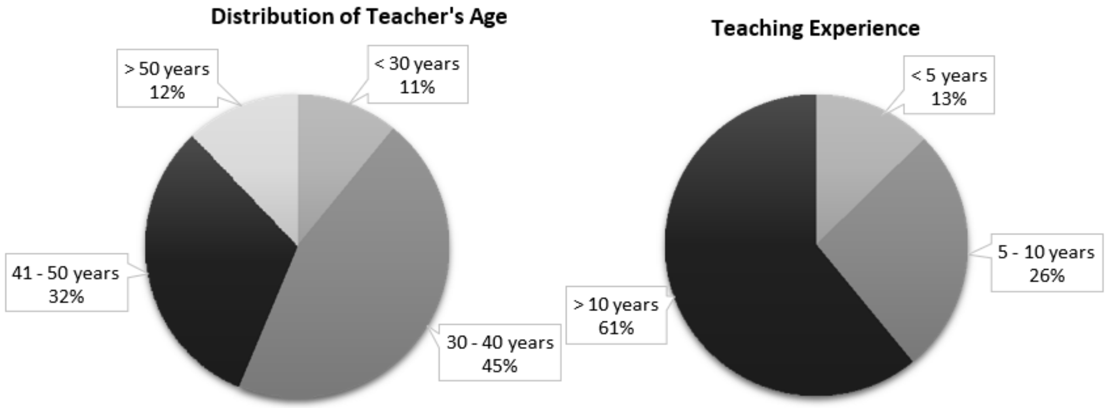

Figure 1: Diagram of the Distribution of Teacher Respondents' Ages and Length of Teaching Experience
Source: Processed from Research Data

Regarding educational background, most teachers held bachelor's degrees, while a smaller proportion had completed postgraduate education, as shown in Figure 2. This diversity provides an opportunity to examine teacher readiness across a broad spectrum of experience and academic competence.

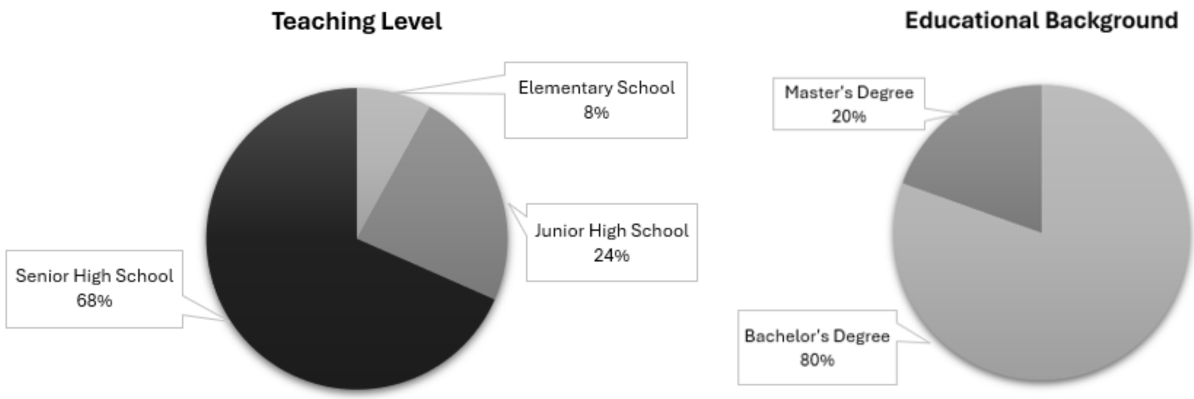

Figure 2: Diagram of the Distribution of Teaching Level and Teacher's Educational Background
Source: Processed from Research Data

Score Calculation and Weighting

The collected data were tabulated and assigned weights, as shown in Table 2 below.

Table 2: Scores and Weighting of Internal and External Factors

Factor	Indicator	Score	Weight	Indicator	Score	Weight
	Strengths			Weaknesses		
Internal	S1	52	0.30	W1	43	0.25
	S2	32	0.18	W2	30	0.17

Factor	Indicator	Score	Weight	Indicator	Score	Weight
	S3	41	0.24	W3	20	0.11
	S4	13	0.07	W4	50	0.29
	S5	36	0.21	W5	31	0.18
	Total	174	1.00	Total	174	1.00
	Opportunities			Threats		
	O1	29	0.17	T1	22	0.13
	O2	27	0.16	T2	44	0.25
External	O3	38	0.22	T3	35	0.20
	O4	42	0.24	T4	36	0.21
	O5	38	0.22	T5	37	0.21
	Total	174	1.00	Total	174	1.00

Source: Processed from Research Data

The weighting results indicate that S1, with a score of 52 and a weight of 0.30, was the most dominant strength. This means that most teachers had a strong personal interest in digital technology. As the factor with the highest weight, it may serve as the primary driving force for encouraging the adoption of coding and artificial intelligence in schools. Furthermore, S3, with a score of 41 and a weight of 0.24, was also prominent, representing school support for the integration of technology into learning. Strong institutional support reinforces the sustainability of the program. Meanwhile, S2, with a score of 32 and a weight of 0.18, and S5, with a score of 36 and a weight of 0.21, were at a lower level. These findings indicate that teachers' familiarity with using technology and their relatively strong confidence in learning new skills may serve as additional supporting strengths. S4, with a score of 13 and a weight of 0.07, was the least prominent strength, indicating that teachers' ability to understand basic programming logic remained limited.

Regarding weaknesses, W4, with a score of 50 and a weight of 0.29, was the most significant weakness, indicating that teachers had not participated in formal coding and artificial intelligence training. This clearly represents a major obstacle that must be addressed through continuous training programs. The next weaknesses were W2, with a score of 30 and a weight of 0.17, and W5, with a score of 31 and a weight of 0.18, representing limited understanding of basic concepts and insufficient time for independent learning. W3, with a score of 20 and a weight of 0.11, was a relatively minor weakness, although it still requires attention.

Regarding external factors, the weighting results indicate that O4, with a score of 42 and a weight of 0.24, was the greatest opportunity, namely students' enthusiasm for learning about technology. This finding suggests that students' external motivation may also serve as a driving force for the successful implementation of the program. Meanwhile, O1, with a score of 29 and a weight of 0.17, and O2, with a score of 27 and a weight of 0.16, were at lower levels, although government support and the availability of online training remained relevant.

The main threat arises from T2, with a score of 44 and a weight of 0.25, representing limitations in schools' technological infrastructure. This was the most significant obstacle and needs to be anticipated through investment in facilities and infrastructure. Moderate threats included T5, with a score of 37 and a weight of 0.21; T4, with a score of 36 and a weight of 0.21; and T3, with a score of 35 and a weight of 0.20. These threats represented public skepticism, disparities in competence among teachers, and a lack of technical guidelines. The least significant threat was T1, with a score of 22 and a weight of 0.13, representing a lack of support from colleagues.

Rating Assignment

The next stage after determining the weights was assigning ratings to each indicator included in the internal and external factor categories. This process aimed to provide a more in-depth understanding of individual respondents' perceptions, in this case teachers, regarding the degree of influence and strength of each indicator in supporting the implementation of coding and artificial intelligence learning.

The ratings were determined using the mode, namely the most frequently occurring rating value, as a representation of the tendency of the majority of respondents. Higher rating results indicate that an indicator was perceived to play a significant role as a determining factor in the successful implementation of deep learning in schools. Thus, the assignment of ratings not only provides a quantitative dimension for each indicator but also reveals strategic priorities based on respondents' collective perceptions. A summary of the rating calculations for each indicator is presented in Table 3.

Table 3: Ratings of Internal and External Factor Indicators

Factor	Indicator	R1	R2	R3	R4	R5	R'	Indicator	R1	R2	R3	R4	R5	R'
	Strengths							Weaknesses						
Internal	S1	2	1	18	43	110	5	W1	41	30	31	24	48	5
	S2	1	9	38	58	68	5	W2	34	40	43	23	34	3
	S3	4	3	28	51	88	5	W3	34	52	41	23	23	2
	S4	27	33	51	35	28	3	W4	48	19	36	14	56	5
	S5	7	14	28	48	77	5	W5	26	33	49	30	35	3
	Opportunites							Threats						
Eksternal	O1	16	16	40	41	61	5	T1	26	32	64	28	24	3
	O2	16	22	36	41	57	5	T2	21	21	57	27	58	5
	O3	5	6	37	48	78	5	T3	21	28	66	21	38	3
	O4	3	6	27	51	87	5	T4	12	24	67	31	40	3
	O5	3	10	31	51	79	5	T5	11	27	61	34	41	3

Source: Processed from Research Data

Note:
R′ = Final rating

IFAS and EFAS Calculations

Based on the weighting and rating results obtained in the previous stage, the next step was to calculate the IFAS (Internal Strategic Factors Analysis Summary) and EFAS (External Strategic Factors Analysis Summary). IFAS was used to calculate the scores of internal strategic factors, including strengths and weaknesses, whereas EFAS was used to assess external strategic factors, comprising opportunities and threats. The scores in both matrices were obtained by multiplying the weight and rating values for each indicator. Thus, the internal indicators were calculated in the IFAS matrix, whereas the external indicators were processed in the EFAS matrix.

Table 4: IFAS and EFAS Calculations

Factor	Indicator	Weight	Rating	Score	Indicator	Weight	Rating	Score
	Strengths				Weaknesses			
Internal	S1	0,30	5	1,49	W1	0,25	5	1,24
	S2	0,18	5	0,92	W2	0,17	3	0,52
	S3	0,24	5	1,18	W3	0,11	2	0,23
	S4	0,07	3	0,22	W4	0,29	5	1,44
	S5	0,21	5	1,03	W5	0,18	3	0,53
				4,85				3,95
	Opportunities				Threats			
Eksternal	O1	0,17	5	0,83	T1	0,13	3	0,38
	O2	0,16	5	0,78	T2	0,25	5	1,26
	O3	0,22	5	1,09	T3	0,20	3	0,60
	O4	0,24	5	1,21	T4	0,21	3	0,62

O5	0,22	5	1,09	T5	0,21	3	0,64
			5,00				3,51

Source: Processed from Research Data (2025).

A summary of the IFAS and EFAS calculation results is presented in Table 4. The calculations produced total scores of 4.85 for strengths (S), 3.95 for weaknesses (W), 5.00 for opportunities (O), and 3.51 for threats (T). These values provide a quantitative overview of the relative position of each factor and may therefore serve as the basis for formulating more focused and proportionate strategies.

Cartesian SWOT Analysis

The IFAS and EFAS scores obtained in the previous stage were subsequently used to determine the coordinate point in the Cartesian coordinate system. The coordinates were calculated using the formula (((S-W)/2, (O-T)/2)), resulting in the point ((0.45, 0.75)). This coordinate position was then mapped onto the SWOT diagram, as presented in Figure 2.

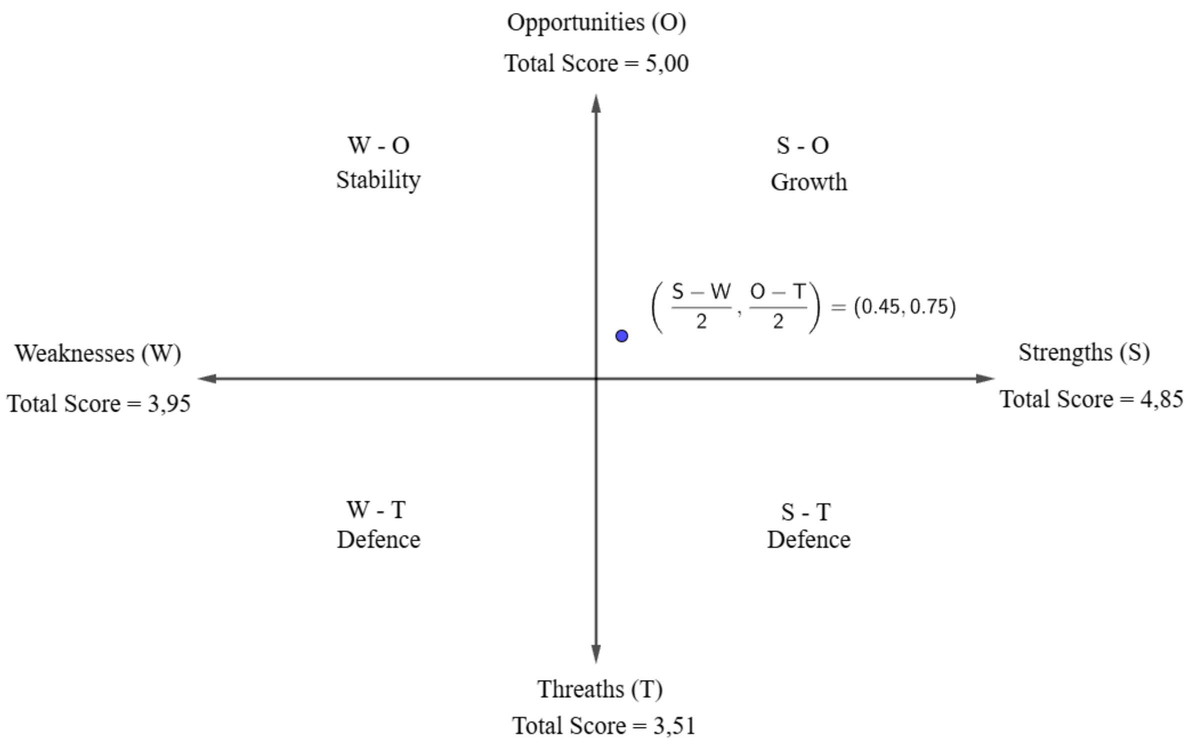

Figure 2: SWOT Analysis Diagram
Source: Processed by the Researchers (2025)

The diagram shows the coordinate point ((0.45, 0.75)), which is located in the Strength–Opportunity (S–O) quadrant, also known as the growth quadrant. This position resulted from the total score for the internal Strength factor (4.85) being higher than that of the Weakness factor (3.95), while the external Opportunity factor had a higher score (5.00) than the Threat factor (3.51). The position in the growth quadrant indicates that a development strategy is the most appropriate option. This means that existing internal strengths, such as teachers' strong interest in technology, school support for digital integration, and confidence in acquiring new skills, can be optimized to take advantage of external opportunities. These opportunities include government support, the availability of free online training, the implementation of the Merdeka Curriculum, and students' enthusiasm for technology-based learning.

Strategic Plan Matrix

Referring to the diagram and the analysis of responses to the open-ended questionnaire items, the next stage was to construct a quantitative strategic plan matrix. The matrix was developed based on the total scores obtained from the IFAS and EFAS calculations. It includes cumulative scores for each strategic alternative, namely S–O, W–O, W–T, and S–T. The value of each strategy was obtained by adding the scores of the internal factors, comprising strengths and weaknesses, to those of the external factors, comprising opportunities and threats. The results of these combinations were then presented in the strategic plan matrix shown in Table 5.

Table 5. Quantitative Matrix for Strategic Plan Combinations

IFAS/EFAS	Opportunities (O)	Threats (T)
Strengths (S)	S–O Strategy: Optimizing strengths to seize opportunities = 9.85	S–T Strategy: Utilizing strengths to address potential threats = 8.36
Weaknesses (W)	W–O Strategy: Reducing weaknesses to pursue opportunities = 8.95	W–T Strategy: Minimizing weaknesses to avoid threats = 7.46

SWOT Matrix

The survey findings from several open-ended questions were generally consistent with the quantitative findings presented previously. A summary of the survey data from the open-ended questions is presented in the following table.

Table 6. Summary of Open-Ended Questionnaire Responses

Main Theme	Subthemes/ Teachers' Focused Responses	Frequency	Representative Quote	Interpretation/ Strategic Implications
Strengths	• Strong motivation to learn about technology. • Support from school principals and colleagues. • Access to basic digital devices, such as laptops and school internet.	68	"I am very interested in learning coding because it is relevant to current developments."	Teachers have strong intrinsic motivation, which can serve as the primary foundation for training programs.
Weaknesses	• Have never participated in formal coding/AI training. • Limited time for independent learning. • Limited practical coding experience.	54	"I have never participated in coding training and do not yet know how to teach it."	The main needs are technical training and flexible learning time for teachers.
Opportunities	• Support from government policies. • Access to online training and digital communities. • Students' enthusiasm for technology.	49	"There are now many free online training programs; it only depends on teachers' willingness to participate."	Opportunities can be maximized by establishing training networks and partnerships.
Threats	• Unequal infrastructure among schools. • Disparities in competence among teachers. • Parents' doubts regarding the importance of coding.	36	"Our school does not yet have enough computers for all students."	Equitable provision of facilities and public awareness initiatives should become policy priorities.
Teachers' Suggestions	• Provide regular training and certification.	41	"Tiered training is needed so	These are concrete

	• Provide simple modules and examples of practical activities. • Strengthen technical support in schools.	that teachers can begin with the basics."	recommendations for developing implementation strategies based on needs in the field.

Source: Processed from Research Data (2023).

The two sets of findings were subsequently described as effective strategic formulations, as presented in Table 7. In accordance with the previous analysis, the primary focus was the S–O strategy, which obtained the highest score of 9.85. However, the following SWOT matrix also includes the other strategies to demonstrate the range of possible strategic alternatives.

Table 7: SWOT Strategy Matrix

IFAS/EFAS	O – Opportunity	T – Threat
S – Strength	S–O Strategy: Optimizing strengths to seize opportunities = 9.85 • Develop continuous training programs that build on teachers' strong motivation (S1) by utilizing government support and free online training programs (O1, O2). • Optimize school management support (S3) to facilitate technological integration and accommodate students' enthusiasm for digital learning (O4). • Utilize teachers' confidence in learning new skills (S5) to expand collaboration among schools, industries, and digital communities (O5). • Establish learning communities as platforms for sharing good practices in digital technology-based learning, including coding and AI, and innovation (S2, O3).	S–T Strategy: Utilizing strengths to address potential threats = 8.36 • Utilize school support and teacher motivation (S1, S3) to address limitations in digital infrastructure (T2) through shared devices and open-source solutions. • Strengthen teachers' roles (S5) in providing information and examples of practice to colleagues to reduce disparities in information and skills (T1, T4). • Develop flexible learning modules to address public doubts regarding the importance of coding (T5).
W– Weakness	W–O Strategy: Reducing weaknesses to pursue opportunities = 8.95 • Organize tiered training to address limited coding experience (W1, W4) by utilizing government policy support and online resources (O1, O2). • Improve teachers' understanding of basic programming concepts (W2) by integrating training into learning-community agendas (O3). • Provide flexible learning time for teachers through asynchronous training schedules (W5, O2).	W–T Strategy: Minimizing weaknesses to avoid threats = 7.46 • Develop a teacher-to-teacher mentoring system to address disparities in technological competence (W2, T4). • Propose the gradual procurement of technological devices so that teachers can access coding and AI materials (W3, T2). • Increase digital literacy awareness programs for

	parents and the community to reduce resistance to new forms of learning (W1, T5).

Source: Processed from Research Data

In the matrix, the S–O strategies formulated based on the findings of this study include several measures. First, teacher capacity should be improved through continuous training programs focusing on basic coding skills and an introduction to AI concepts. These training programs can capitalize on teachers' strong motivation to learn and government policy support, which currently places considerable emphasis on promoting digital literacy.

Second, school management support should be optimized to strengthen the existing digital infrastructure so that teachers can directly implement the skills acquired through training. Third, collaboration among schools, digital communities, and industries should be expanded to provide practical experiences for teachers while enriching learning resources. These strategies are considered relevant because they are consistent with the identified strengths and opportunities.

Discussion of the research findings indicates that teacher readiness cannot be separated from the context of national education policy. Regulations issued by the Ministry of Primary and Secondary Education[8] [9] concerning the integration of coding and artificial intelligence have provided clear policy direction. However, their success remains dependent on teachers' readiness as implementers. In the field of AI, a recent systematic review demonstrated that the successful integration of AI into classrooms is strongly dependent on teachers' AI literacy, including knowledge, ethics, and practice, as well as the availability of structured training that develops confidence and pedagogical competence rather than merely technical familiarity with tools [19].

Optimizing school management support and digital leadership is positively correlated with school effectiveness in the era of technological transformation. A cross-national meta-analysis demonstrated that school principals' digital leadership, including policy direction, infrastructure support, and a culture of innovation, is an important driver of improved institutional outcomes. This finding implies the importance of investment and internal school policies [20].

Furthermore, collaboration among schools, digital communities, and industries enriches learning resources and provides teachers with authentic practical experiences. Recent case studies and reviews of STEM partnerships have found that networks involving universities and industries expand access to materials, examples of authentic projects, and professional mentoring for teachers. The greatest benefits are experienced in teachers' professional development, including project-based pedagogy, understanding of industrial practices, and the curation of open resources, which subsequently affect the quality of student learning [21]. Additional evidence from computational thinking programs for early childhood and primary education, including robotics and CT4ECE (Computational Thinking for Early Childhood Educators), indicates that structured, project-based training followed by practical mentoring encourages classroom implementation and fosters teacher readiness across educational levels. These findings strengthen the rationale for the S–O strategy of establishing interschool learning communities as platforms for sharing good practices [22].

Overall, the SWOT analysis in this study confirms that teacher readiness can be strengthened through synergy among individual motivation, school support, and external policy opportunities. This combination enables digital transformation to occur more rapidly. However, to maintain sustainability, a continuous evaluation mechanism for teacher-training programs needs to be designed. Such evaluation is important to ensure that training is not conducted only once but becomes an ongoing process that is continuously adapted to technological developments.

Overall, the research findings confirm that teachers in West Java are in a positive position regarding their readiness to integrate coding and artificial intelligence. Teachers' strong motivation and national policy support represent substantial resources that can be utilized. However, limitations in technical skills and infrastructure remain challenges that must be addressed immediately. The recommended S–O strategies, namely continuous training, strengthened school support, and external collaboration, are expected to accelerate the integration of coding and artificial intelligence in schools. Through these strategies, digital educational transformation in Indonesia has a strong likelihood of succeeding.

Conclusion

Aligned with the three main objectives of this study, several key conclusions can be drawn:

First, regarding internal factors, the most prominent strengths lie in teachers' high motivation to learn new technologies, positive support from school management, and teachers' habitual use of digital tools in their teaching practices. These three aspects indicate a solid foundation of psychological readiness, institutional support, and basic digital competence. However, several weaknesses also require attention, including limited technical proficiency in coding and artificial intelligence, lack of experience in formal training programs, and insufficient time for self-development. These factors suggest that while teachers demonstrate strong motivation to learn, sustained support through continuous training and mentoring remains essential.

Second, from the perspective of external factors, this study found that government policy support constitutes the most significant opportunity for strengthening the implementation of CAI in schools. The issuance of official regulations incorporating Coding and AI into the national curriculum, along with the increasing availability of online learning resources, provides a strong foundation for teachers' continuous professional growth. Furthermore, students' enthusiasm for digital technology and the potential for collaboration with industry and technology communities open wide opportunities for innovative learning practices. On the other hand, disparities in infrastructure across regions, gaps in digital competence among teachers, and the resistance of a small segment of society toward new technology-based learning remain challenges that must be anticipated to ensure equitable policy implementation.

Third, based on the results of the IFAS and EFAS matrix calculations, teachers' readiness is positioned within the *Strength–Opportunity (S–O) quadrant*, indicating the need for a progressive development strategy. In other words, the internal strengths already possessed by teachers and schools should be optimized to seize the external opportunities available. The strategies formulated from this study consist of three main actions:

(1) Strengthening teachers' capacity through continuous professional development programs focused on coding and artificial intelligence (AI).
(2) Optimizing institutional support within schools by providing adequate digital infrastructure, establishing innovative school teams, and allocating dedicated time for teachers' professional growth.
(3) Expanding external partnerships with digital communities, higher education institutions, and industry sectors to foster more contextual and practice-oriented learning.

Overall, this study concludes that teachers' readiness in West Java demonstrates a positive trajectory toward the effective implementation of coding and AI learning. Strong internal potential, when accompanied by adequate policy and infrastructural support,

will serve as a crucial foundation for cultivating a sustainable culture of digital learning in Indonesian schools.

Based on the findings and analysis, several recommendations can be proposed for stakeholders involved in the implementation of coding and artificial intelligent learning.

(1) For teachers, continuous efforts are required to strengthen digital competencies, either through formal training, online courses, or self-directed learning activities. Teachers are also encouraged to actively participate in professional learning communities to share experiences and expand networks of best practices.
(2) For schools, institutional support is the key to success. Schools need to ensure the availability of basic technological infrastructure, allocate time and budget for teacher training, and create a work environment that supports learning innovation. Visionary and collaborative school leadership will play a crucial role in accelerating this adaptation

process.

(3) For the government and education authorities, it is necessary to develop follow-up policies that are implementative in nature, such as organizing tiered national training programs for teachers, providing technical guidelines for the Coding and AI curriculum, and ensuring equitable access to digital devices and internet connectivity in regional schools. Consistent, needs-based policy support will strengthen the sustainability of this program.

Through well-directed collaboration and implementation strategies grounded in the identified strengths and opportunities, the transformation of coding and artificial intelligence learning in schools can be carried out more effectively.

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Ethical Clearance

Formal ethical approval was not required for this study because it involved a minimal-risk survey in an educational setting. However, the study adhered to ethical principles for research involving human participants. Informed consent was obtained from all respondents, participation was voluntary, and all data were treated confidentially and anonymously.

AI Declaration

The authors used ChatGPT to assist with language translation and language editing during the preparation of this manuscript. The tool was used only to improve the clarity and readability of the text. All AI-assisted outputs were reviewed and revised by the authors, who take full responsibility for the final content of the manuscript.

Declaration statement

This manuscript is original, has not been published previously, and is not under consideration for publication elsewhere. The authors declare no conflict of interest. The data supporting the findings of this study are available from the corresponding author upon reasonable request. All authors contributed substantially to the study and approved the final manuscript.

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